

7/19/2006

STAFF REPORT

In the matter of

United Water Toms River

Application No. 5001 to modify permit to divert water from 18 existing wells and 2 new wells, ASR-46 and ASR-47 in the Middle Potomac-Raritan-Magothy aquifer in the Township of Dover, Ocean County

In compliance with the provisions of N.J.S.A. 58:1A-1 et seq., United Water Toms River, 15 Adafre Avenue, Toms River, New Jersey 08753, filed an application with the Department of Environmental Protection on September 8, 2005 to divert a maximum of 770 million gallons of water during any month (mgm) at a maximum rate of 20,200 gallons per minute from 18 existing wells, Nos. 15, 20, 21, 22, 24, 26, 28, 29, 30, 31, 37, 39, 40, 41, 42, 43, 44, and 45, 58 to 1875 feet deep, screened in the Kirkwood-Cohansey, Piney Point and Upper and Middle Potomac-Raritan-Magothy (UPRM & MPRM) aquifers, and new Wells ASR-46 and ASR-47, 1875 and 1938 feet deep screened in the MPRM aquifer. Original existing Test Well 46, in the UPRM, was abandoned and a new Test Well 46 (now ASR 46) was relocated, deepened, and completed in the MPRM. United Water Toms River (UWTR) is also requesting the following increases:

- Increase the monthly allocation from the Piney Point aquifer from 172 mgm to 240 mgm and establish an annual allocation of 1560 mgy.
- Increase the monthly allocation from the Kirkwood/Cohansey aquifer by 40 mgm.
- Increase the combined monthly allocation from Water Allocation Permit Nos. 5000 and 5001 from 554 mgm to 770 mgm.
- Increase the combined annual allocation from Water Allocation Permit Nos. 5000 and 5001 from 4282 mgy to 6010 mgy.
- Increase the combined monthly allocation of the Kirkwood/Cohansey aquifer from Water Allocation Permit Nos. 5000 and 5001 from 400 mgm to 440 mgm and establish an annual allocation of 3000 mgy.

UWTR is also requesting to establish an annual allocation from the UPRM aquifer of 940 mgy.

Diversion is for the purpose of Public Water Supply and serves the following communities: Dover Township, South Toms River Borough and portions of Berkeley Township.

Public notice was required due to the requested increase in monthly and annual allocations, the establishment of new annual allocation limits, and the addition of two new ASR wells.

A public hearing was requested and is scheduled for September 13, 2006, 3:00 to 8:00 P.M. at the Toms River North High School (Ritacco Center).

Background/Findings of Fact

1. Water is requested to be diverted under this modified permit for public water supply from the following sources at the maximum rates specified below:

Groundwater

Well Permit No.	Well Name or Designation	Pump Capacity (gpm)	Depth (feet)	Aquifer
3300001147	20	500	85	Kirkwood-Cohansey
3300001185	21	700	60	Kirkwood-Cohansey
3300001229	22	700	126	Kirkwood-Cohansey
3300001227	24	700	125	Kirkwood-Cohansey
3300001231	26	700	134	Kirkwood-Cohansey
3300002075	28	700	125	Kirkwood-Cohansey
3300002076	29	700	135	Kirkwood-Cohansey
2900009781	31	700	102	Kirkwood-Cohansey
3300035775	44	450	141	Kirkwood-Cohansey
3300000829	15	700	225	Piney Point
3300023928	37	800	238	Piney Point
3300026307	39	450	302	Piney Point
3300027487	40	1900	340	Piney Point
3300030281	41	250	301	Piney Point
3300031998	43	1400	276	Piney Point
3300032509	42	1250	1348	Upper PRM
3300037783	45	1000	1348	Upper PRM
2900041799	ASR-46	2400	1756	Middle PRM
3300044152	ASR-47	2100	1938	Middle PRM
3300010224	30	2100	1875	Middle PRM

2. List of well field groups and remaining individual well:

Holly Plant		
Well Name or Designation	Well Permit No.	Location Description
Well 21	3300001185	Waterline Road, south of Parkway Station, Southern section of Dover Twp.
Well 30	3300010224	
Well 37	3300023928	
Parkway Station		
Well 20	3300001147	Gardenia Way & Indian Head Road, west of Garden State Parkway and southwest of Reich Farm.
Well 22	3300001229	Dugan Lane, Dugan Lane & Cedar Row, east of Garden State Parkway and south of Reich Farm, Wells 44 & 45 east of Garden State Parkway and furthest south in well field, Cohansey Sources in this well field group are down gradient from Reich Farm.
Well 24	3300001227	
Well 26	3300001231	
Well 28	3300002075	
Well 29	3300002076	
Well 39	3300026307	
Well 41	3300030281	
Well 42	3300032509	
ASR 47	3300044152	
Well 44	3300035775	
Well 45	3300037783	
Whitesville ASR Facility		
Well 31	2900009781	McPherson Street, northwest of Parkway Station.
ASR 46	2900041799	
Brookside Plant		
Well 15	3300000829	Cedar Grove Road & Brookside Drive, southeast of Parkway Station.
Well 43	3300031998	
Individual Location		
Well 40	3300027487	Windsor Avenue & Hamilton Drive, southeast section of Dover Twp.

- This application request is for two new ASR diversions (ASR 46 & ASR 47), new annual allocation limits, and modification of individual and combined allocations granted previously under Water Allocation Permits 5000 and 5001.
- The applicant's diversion sources (Wells 30, ASR 46 and ASR 47) are located within the depleted and threatened portion of the MPRM of Area of Critical Water Supply Concern No. 1 and their portion of

the safe and dependable yield of the MPRM aquifer has been determined to be 629.591 mgy.

- 5a). A review of quarterly diversion reports indicates the following water use from all sources under Permit No. 5001:

Year	Annual Use (mg)	Maximum Monthly Use (mg)	Average Monthly Use (mg)	Existing Allocation (mgm)
2005	3576.513	419.658	298.043	432
2004	3651.146	404.614	304.263	432
2003	3325.947	395.233	277.162	432
2002	3369.913	396.727	280.826	432
2001	3214.929	416.202	267.911	432

- 5b). A review of quarterly diversion reports indicates the following combined water use from all sources under Permit Nos. 5000 and 5001:

Year	Annual Combined Use (mg)	Maximum Monthly Combined Use (mg)	Average Combined Monthly Use (mg)	Existing Combined Allocation (mgm) (mg)
2005	4794.212	565.063 (Aug.)	399.518	554 4,282
2004	5107.209	544.832 (July)	425.601	554 4,282
2003	4730.072	503.298 (July)	394.173	554 4,282
2002	4779.463	544.007 (July)	398.289	554 4,282
2001	4536.712	552.102 (July)	378.059	554 4,282

- 5c). A review of quarterly diversion reports indicates the following water use from Cohansey sources under Permit No. 5001:

Year	Annual Use (mg)	Maximum Monthly Use (mg)	Average Monthly Use (mg)
2005	1545.131	138.371 (Mar.)	128.750
2004	1565.209	146.998 (July)	130.417
2003	1571.282	144.595 (Jan.)	130.917
2002	1563.962	144.241 (Oct.)	130.333
2001	1304.059	147.788 (June)	108.667

5d). A review of quarterly diversion reports indicates the following water use from Piney Point sources under Permit No. 5001:

Year	Annual Use (mg)	Maximum Monthly Use (mg)	Average Monthly Use (mg)	Existing Allocation (mgm)
2005	1305.577	160.538 (Aug.)	108.798	172
2004	1199.845	145.983 (July)	99.987	172
2003	1131.698	160.149 (July)	94.308	172
2002	1104.207	137.974 (July)	92.017	172
2001	1525.496	178.308 (May)	127.125	172

5e). A review of quarterly diversion reports indicates the following water use from Middle FRM sources under Permit No. 5001:

Year	Annual Use (mg)	Maximum Monthly Use (mg)	Average Monthly Use (mg)	Existing Allocation (mgm)	(mg)
2005	485.083	80.966 (Aug.)	40.424	90	629.591
2004	607.761	81.848 (Aug.)	50.647	90	629.591
2003	528.337	82.421 (July)	44.028	90	629.591
2002	537.002	79.716 (Oct.)	44.75	90	629.591
2001	524.531	76.828 (May)	43.711	90	629.591

5f). A review of quarterly diversion reports indicates the following water use from Upper PRM sources under Permit No. 5001:

Year	Annual Use (mg)	Maximum Monthly Use (mg)	Average Monthly Use (mg)	Existing Allocation (mgm)
2005	240.655	53.537 (July)	20.055	145
2004	279.964	33.406 (July)	23.330	145
2003	93.601	19.372 (July)	7.800	145
2002	201.125	50.897 (July)	16.760	145
2001	135.21	49.236 (July)	11.268	145

6. The population served under Water Allocation Permit Nos. 5000 and 5001 is approximately 123,680, which represents an average monthly consumption of 104 gpcd, and a peak monthly consumption of 140 gpcd

based upon 2005 water use data, with a 95 percent residential use component.

7. The applicant's diversion sources are located within: Planning Area 16; Toms River as designated by the New Jersey State Water Supply Master Plan; the Coastal North Drought Region; and the Barnegat Bay Watershed Management Area No. 13.
8. A site inspection was conducted on March 14, 2006. The following information was obtained during this inspection:

Well Name or Designation	Well Condition	Pump House Condition	Pump Type/ Horse Power	Air Line and Gage	Able to Measure Static Water Level By Tape	Meter Type	Meter Reading (mg)
Holly Plant							
Well 21	Fair	None	Vertical Turbine (VT)	Yes	Yes	Neptune	0
Well 30	Good	Excellent	VT	Yes	Yes	Neptune	928.642
Well 37	Fair	Excellent	VT	Yes	Yes	Neptune	956.391
Parkway Station							
Well 20	Good	Excellent	VT	Yes	Yes	Neptune	0
Well 22	Fair	None	VT	Yes	Yes	McCrometer	83.785
Well 24	Fair	None	VT	Yes	Yes	McCrometer	713.968
Well 26	Good	Excellent	VT	Yes	Yes	Neptune	5.732
Well 28	Good	Good	VT	Yes	Yes	Neptune	320.816
Well 29	Good	Good	VT	No	Yes	Neptune	648.861
Well 39	Excellent	Excellent	VT	Yes	Yes	McCrometer	13.089
Well 41	Good	None	VT	Yes	Yes	McCrometer	330.456
Well 42	Excellent	Excellent	VT	No	Yes	Neptune	180.379
Well 44	Good	Excellent	VT/30 HP	Yes	Yes	Neptune	82.232
Well 45	Good	Excellent	VT/200 HP	Yes	Yes	Neptune	348.990
ASR 47	Excellent	None	VT/150 HP	Yes	Yes	Neptune	None
Whitesville ASR Facility							
Well 31	Good	Excellent	VT	Yes	Yes	McCrometer	4.458
ASR 46	Good	Excellent	VT	Yes	Yes	Gonic	0.774
Brookside Plant							
Well 15	Good	Excellent	VT	Yes	Yes	Neptune	688.930
Well 43	Good	Excellent	VT/100 HP	Yes	Yes	Neptune	856.983
Individual Location							
Well 40	Good	Excellent	VT	Yes	Yes	Neptune	690.142

The sources are located as follows:

	NJ State Plane Feet X	NJ State Plane Feet Y	Location
Holly Plant			
Well 21	573978.1	408248.9	Waterline Road
Well 30	574037.1	406016.6	Waterline Road
Well 37	573800.5	408716.6	Waterline Road
Parkway Station			
Well 20	570707	422270.8	Gardenia Way & Indian Head Road
Well 22	574609.8	423546.6	Dugan Lane
Well 24	575428.9	423214.7	Dugan Lane & Cedar Row
Well 26	574238.2	422778.7	Dugan Lane
Well 28	574452.3	423252.1	Dugan Lane
Well 29	574646.1	422950.4	Dugan Lane
Well 39	575435.7	423191	Dugan Lane & Cedar Row
Well 41	574578.2	423497.8	Dugan Lane
Well 42	574612.9	423197.5	Dugan Lane
Well 44	573665.6	421681.8	Parkway South
Well 45	573874	421662.4	Parkway South
ASR 47	574653	423171	Dugan Lane
Whitesville ASR Facility			
Well 31	564079.5	439915.3	McPherson Street
ASR 46	564090.3	439887.6	McPherson Street
Brookside Plant			
Well 15	583830	413389.4	Cedar Grove Road & Brookside Drive
Well 43	583771.6	413301.2	Cedar Grove Road & Brookside Drive
Individual Location			
Well 40	596405.7	409451	Windsor Avenue & Hamilton Drive

9. Flow meters for all diversion sources (except ASR 47) have been calibrated within the past 5 years. The most recent date of calibration is November 11, 2005.

10. The following wells have been abandoned, decommissioned, are inactive or unused:

Well No.	Well Permit No.	Depth (feet)	Status
Test Well 46	3300037088	1360	abandoned

11. The applicant has exceeded their monthly and annual allocation limits. An Administrative Consent Order was signed in November 2005 addressing this issue and included stipulated penalties for future violations.
12. The diversion is not in the Pinelands Management Area.
13. Water, after use, will be discharged to Ocean County Utilities Authority for treatment and discharge to the Atlantic Ocean under Permit No. NJ0029408. The treatment works are not under a sewer connection ban or other restriction imposed by NJDEP.
14. The system has the following interconnections with adjacent systems:

Name of System	Size of Interconnection	Use
New Jersey American	4 & 8 inch	Emergency
Island Heights	4 inch	Emergency
Borough of Beachwood	4 inch	Emergency
Manchester Township	4 inch	Emergency

15. The applicant has agreements for the sale or purchase of water from the following:

Name of System	Sale or Purchase	Quantity	Date of Contract
New Jersey American	Purchase	1.0 mgd	5/27/97
Island Heights	Sale/Purchase	0.72 mgd	5/1/92
Borough of Beachwood	Sale	0.72 mgd	1/19/05
Manchester Township	Sale/Purchase	500 gpm & 1.728 mgd	9/1/83 & 9/21/05

16. The system is 99 percent metered. According to the application, there are 46,120 domestic service taps and 45,572 domestic meters. The 2,437 commercial and industrial services are 100 percent metered.

17. The applicant has indicated that their unaccounted-for-water was 12.1 percent for 2004.
18. The water system (Permit Nos. 5000 & 5001) has storage capacity of 8.9 mg, as compared with a 2005 average water demand of 13 mgd.
19. The applicant submitted a Water Conservation Plan in October 2004.
20. There are 153 small capacity/domestic sub-surface diversions in the same aquifer (Kirkwood-Cohansey) within a 1.25 mile radius of the Parkway Well Field.
21. Sub-surface diversions in the same aquifer as Well Nos. 15, 37, 39, 40, 41 & 43 (Piney Point) within the radius of influence include the following:

Well Owner	Well Permit No.	Depth (feet)	Capacity (gpm)	Distance (miles)
Applebach, Fred	2901466	180	10	0.90
Congregation Bnai I'	2933135	200	60	0.60
Grone, Victoria	3328692	200	10	0.95
Toms River, YMCA	2932884	200	50	0.70
Osp. Drive Corp	2903664	200	50	0.98
Spiegeland, Oscar	3300330	300	60	0.95
Szewczuk Construction	3323733	180	15	0.42
Lloyd, Clifford	3326986	185	12	0.38

22. Sub-surface diversions in the same aquifer as ASR Wells 46 & 47 (Middle PRM) within the radius of influence include the following:

Well Owner	Well Permit No.	Depth (feet)	Capacity (gpm)	Distance (miles)
Brick Twp. MUA	2906841	1779	838	5.3
Brick Twp. MUA	2907791	1832	2300	5.2
Brick Twp. MUA	2912006	1874	1800	5.4
Ralph Clayton & Sons	2903742	1552	1500	5.0
NJ American Water Co.	2906549	2050	1500	2.7
Lakewood Twp. MUA	2909259	1628	1500	3.4
Jackson Twp. Legler Section	2952272	1728	200	5.0

23. Public water supply wells regulated by the Water Allocation Permit program, within a 5-mile radius of ASR-46 (1756 feet deep, MPRM), ASR-47 (1938 feet deep, MPRM), Parkway Well Field (Kirkwood-Cohansey), and Well Nos. 15, 39, 14, & 43 (225, 302, 301, & 276 feet deep, Piney Point) include the following:

Well Owner	No. Of Wells	Depth (feet)	Aquifer	Capacity (gpm)	Distance (miles)
Manchester Township	10	83 to 1471	Cohansey, UPRM	300 to 1800	1.4 to 4.6
NJ American Water Co.	12	97 to 2050	Cohansey, Englishtown & MPRM	345 to 1500	1.8 to 4.9
Ocean Gate Water Dept.	2	366 to 398	Piney Point	350	3.4 to 3.5
Naval Air Eng. Station Lakehurst	11	56 to 1041	Cohansey, UPRM	80 to 280	4.0 to 4.6
Lakehurst Water Dept.	9	35 to 1470	Cohansey, UPRM	60 to 530	4.8 to 4.9
Jackson Twp. Water Dept.	2	1161 to 1775	UPRM, MPRM	200	4.7
Cedar Glen West Water Co.	3	66 to 152	Cohansey	60 to 230	2.5 to 2.7
Lakewood Township	9	81 to 1625	Cohansey, Englishtown & MPRM	260 to 1500	2.3 to 4.9
Pine Beach Borough	2	197 to 207	Kirkwood	500	4.7 & 4.8
Aqua NJ - Berkeley Water Co.	1	219	Kirkwood	700	4.8
Beachwood Borough Water Dept.	2	216 to 247	Kirkwood	700 & 750	4.5 & 4.8
Island Heights Borough	2	298 to 350	Manasquan, Piney Point	400 & 500	4.3 & 4.7

24. According to the DEP-GIS-Imap 2001 Contaminated Sites list, and OPRA On-line Report web page information, potential pollution sites within twice the radius of influence, up to one mile, of the Parkway Well Field (Kirkwood-Cohansey) diversion include:

Name of Source	Distance (feet)	Program Interest, Remedial Level Code	Lead Agency
Joes Precision Automotive Inc.	4000	016657, C2	BOMM

Name of Source	Distance (feet)	Program Interest, Remedial Level Code	Lead Agency
Le-Ed Concrete & Supplies	5000	011330, D	BCM
Pleasant Plains State Police	3840	018505, C2	BSCM
Reich Farms	5000	011174, D	BCM
Singin	3840	015354, C2	BSCM

25. The estimated consumptive use of water is 100 percent, which is equivalent to 9.8 mgd for Permit No. 5001.

Staff Analysis and Conclusions

1. The applicant's current water use is reasonable.
2. Demand projections provided by the applicant indicate that their ten year demands will be 770 mgm, and 6,010 mgy based on a straight line graph projection correlating to maximum monthly and annual water use for the years 1990 to 2004. According to the applicant, there are currently 62 (approved and pending) projects with associated average demands of 20.207 mgm and 156.822 mgy. Combining their demands with past peak use results in demands of 585 mgm and 5,264 mgy. This is approximately 10 percent above their current annual usage.

Analysis of this in conjunction with historical use shows that the sum of the individual aquifer allocations should be approved at this time, totaling 663 mgm. A comparison of the ratio of maximum monthly use to annual use for the applicant indicates that an annual allocation of 5860 mgy should be sufficient to meet their needs.

Therefore, the applicant has not demonstrated the demand for the allocation that was requested in their application. However, the request for any additional allocation could not be granted based on aquifer limitations and the allocation requests filed as part of this application.

3. Public community water supply systems are in the public interest because they are generally safer and more reliable than individual domestic wells that are not subject to the same testing, monitoring and standards as a public community supply well. Therefore, the proposed diversion is considered to be in the public interest in accordance with N.J.A.C. 7:19-2.2(f)1.

4. The proposed diversions are located within Planning Area No. 16, Toms River of the New Jersey Statewide Water Supply Plan, August 1996 (NJSWSP). According to the NJSWSP, in Area No. 16, there is a significant estimated water supply deficit projected, which may require the implementation of new initiatives. There are issues of saltwater intrusion, large scale depletive water use, and available water supply from critical aquifers within Water Supply Critical Area 1. The NJSWSP recommends that estimated water supply availability and demand numbers need to be evaluated with greater detail and accuracy. If the numbers verify a deficit then the initiatives should be evaluated. The NJSWSP ground-water supply management recommendations state the need for a water conservation program, comprehensive depletive water use reduction, management of ground water withdrawals, an interconnections project, flood skimming during high flow and aquifer use during low flow for non potable diversions, conjunctive water use of shallow aquifers during winter and confined aquifers during summer. Protection of existing aquifer recharge and water quality (both surface and ground water) is also needed. A comprehensive hydrogeologic investigation is currently being conducted by the USGS in cooperation with NJDEP in this region to determine when initiatives should be acted upon with respect to priority.

The ASR wells represent conjunctive use of the shallow and confined aquifers. Therefore, this application is in accordance with N.J.A.C. 7:19-2.2(h).

5. The applicant has the ability to purchase water from New Jersey American, Island Heights, and Manchester Township, which are considered as alternate sources of water. There is no need to develop an alternate source at this time. However, due to growth within these other systems, in the future they may not have water to sell to the applicant. Therefore, the applicant should plan accordingly in order to meet future needs.

Kirkwood-Cohansey

6. The Kirkwood-Cohansey aquifer system in the New Jersey Coastal Plain is predominantly unconfined, although perched water tables and semi-confined conditions caused by the presence of clay units are found locally. The majority of the aquifer system consists of the Kirkwood Formation and Cohansey Sand. In the subsurface updip from the coast, fine to medium quartz sand and silty sand are common. A regionally extensive clay unit, which is in the lower part of the Kirkwood formation, forms the base of the Kirkwood-Cohansey aquifer system. The Cohansey sand is composed of medium- to coarse-grained quartz sand with some gravel and silt. Thin,

interbedded clay layers are common. Locally, the Kirkwood-Cohansey formation ranges to a depth of approximately 200 feet. The Cohansey is the shallower aquifer associated with this formation, with the water table at the Parkway Well Field found at a depth of approximately 30 feet below grade. There is a direct hydraulic connection between the Cohansey and the deeper Kirkwood water bearing formation.

7. The proximity of the unconfined aquifer system (surficially, the Cohansey Sand) to the land surface causes it to be susceptible to contamination. Therefore, the quality of water in the aquifer is of great importance, since it is a major source of drinking water.

According to the 1999 Public Health Assessment of Reich Farm (RF), current conditions indicate that exposure to contaminants from the RF site is no longer occurring. The exposure pathway through private well use was interrupted by the establishment of a well restriction zone, and there is no indication that private wells are still in use for potable purposes in the vicinity of the RF plume. The exposure pathway through the community water supply has been interrupted by the diversion and treatment of contaminated water from Wells 26 and 28 at the Parkway Well Field (PWF), and the recent installation of treatment for Well 29, which has shown sporadic RF related contamination. Treatment was also extended to Well 22 as a precaution. However, according to the Bureau of Safe Drinking Water, treated water (meeting potable drinking water standards) from Wells 26 and 28 may be pumped into the community water supply in times of high water demand in lieu of being pumped to waste. Containment of the RF related groundwater plume through effective management of the PWF is critical to ensure that currently unaffected wells remain so. In addition, proper operation of the treatment systems in place is necessary to reduce and/or eliminate the entry of RF related contaminants into the distribution system. Ongoing water monitoring should continue to document the effectiveness of the well field management and treatment systems. For these reasons, the New Jersey Department of Health and Senior Services categorizes the RF site as no apparent public health hazard under present conditions.

The original treatment on Wells 26 and 28 in 1988 was packed tower aeration (air stripper) to remove VOC contamination, and the installation of an activated carbon filtration system was added in 1996 as an added level of safety, even though the wells were not used routinely for public water supply. The Department has recommended that treatment of wells impacted by the RF groundwater contamination continue until the plume no longer threatens the wells, and that the use of wells with higher radiological activity

should be minimized, when possible until treatment for Radium removal is provided.

8. Upon review of the modification application, the New Jersey Geological Survey (NJGS) has recommended that due to ongoing contamination issues from the hydraulically up-gradient RF site and the use of Wells 26 and 28 as treatment wells, that no diversion increase at the PWF (from Kirkwood-Cohansey diversion sources) should be granted. NJGS has determined that any increase may create hydraulic conditions that accelerate the migration of contaminants at the site causing the current remediation scheme to be ineffective. Numerical modeling has indicated that even slight increases in pumping volumes at the PWF creates hydraulic conditions that may encourage the existing plume to migrate to the south bypassing the remediation wells. Additionally, any increased pumping at the PWF (from Kirkwood-Cohansey diversion sources) may also render the current monitoring well network ineffective at detecting potential contaminants due to changes in the hydraulic flow field. Furthermore, the PWF has experienced issues in the past with increasing pumping at specific wells within the well field, which has shown subsequent contamination spikes in monitoring wells at the site.

For these reasons, the Department has decided to set PWF monthly and annual allocation limits on the Kirkwood-Cohansey diversion sources to ensure that no additional PWF diversion will occur than has recently, to maintain control of the existing long-term steady-state aquifer conditions. The limits should be based on historical water usage from Wells 20, 22, 24, 26, 28, 29 & 44 for the years 1999 through 2005. A review of the quarterly diversion reports indicates the following water use from the Kirkwood-Cohansey diversion sources at the PWF:

Year	Annual Use (mg)	Maximum Monthly Use (mg)
2005	1237.131	112.495
2004	1282.169	119.034
2003	1291.864	119.338
2002	1294.043	118.396
2001	1161.934	114.339
2000	1211.849	112.212
1999 *	1305.345	126.615

* Peak monitored usage.

Upon review it was noted that the maximum water use has occurred in the year 1999 (drought year). The new PWF limits should be set at

126 mgm and 1305 mgy, based on the reported 1999 peak monitored water use.

9. The applicant has requested an increase in the Kirkwood-Cohansey monthly allocation of 40 mgm a month to account for the continuous monthly pumping at Wells 26 and 28 for approximately 30 years.

A review of the quarterly diversion reports indicates the following water use from all of the Kirkwood-Cohansey aquifer diversion sources regulated under Permit 5001:

Year	Annual Use (mg)	Maximum Monthly Use (mg)	Average Monthly Use (mg)
2005	1545.131	138.371	128.750
2004	1565.209	146.998	130.417
2003	1571.282	144.595	130.917
2002	1563.932	144.241	130.333
2001	1304.059	147.788	108.667

The applicant has requested an increase of 40 mgm from its Kirkwood-Cohansey sources to account for the volume of water being pumped monthly overland from Wells 26 and 28. A review of the quarterly diversion reports indicates the following water use from Wells 26 & 28 that is pumped overland:

Year	Annual Use (mg)	Maximum Monthly Use (mg)	Average Monthly Use (mg)
2005	437.247	40.910	36.437
2004	445.806	39.628	37.151
2003	461.952	41.308	38.496
2002	439.799	41.088	36.650
2001	413.845	37.315	34.487

Permit Nos. 5000 and 5001 share a monthly allocation limit of 400 mgm from their Kirkwood-Cohansey sources and Permit 5000 has an individual Cohansey limit of 201.5 mgm. An application to modify the Kirkwood-Cohansey limit under Permit No. 5000 has not been filed. Therefore any increased diversion would come from sources included under Permit No. 5001. Based on the issues discussed in item 8 above that the Department should not grant any additional increase from the Kirkwood-Cohansey diversion sources at the PWF.

Any additional water usage would have to come from the remaining Kirkwood-Cohansey Wells 21 and 31 outside of the PWF. If these wells are operated continuously, a total of 62 mgm could be diverted. Therefore the total that can be pumped from the

Kirkwood-Cohansey sources under Permit No. 5001 would be 188 mgm (126 mgm + 62 mgm). The recalculated combined monthly allocation limit of the Kirkwood-Cohansey aquifer from Water Allocation Permit Nos. 5000 and 5001 should then be set at 389.5 mgm, which is a reduction from the existing combined allocation of 400 mgm. Consequently, the Department should not grant the requested additional 40 mgm allocation from the Kirkwood-Cohansey diversion sources of Permit 5001.

The proposed diversion of 62 mgm from Wells 21 and 31 is just and equitable to the other Kirkwood-Cohansey aquifer water users in accordance with N.J.A.C. 7:19-2.2(f)3.

10. Natural replenishment of ground water within the Kirkwood-Cohansey aquifer is probably occurring because the observed fluctuations do not follow a continual decreasing trend and the fluctuations can be attributed to seasonal usage.

The applicant has indicated that approval of the use of Kirkwood-Cohansey would not exceed the natural replenishment or safe yield (water available continuously during projected future conditions, without creating undesirable effects) of the water resource or threatened to exhaust such waters. The Bureau's analysis of the application in conjunction with the NJGS review of the technical report confirms this, provided no increase in diversion from the PWF is approved.

Therefore, approval of this application at the recommended rates is in accordance with N.J.A.C. 7:19-2.2(f)2.

11. Based upon the information provided by the applicant, the diversion is not expected to contribute to the spread of groundwater pollution. According to the applicant's consultant, the diversion is not expected to contribute to the spread of groundwater pollution because the wells are existing approved diversion sources with no request to increase their pumping capacity and should not influence the hydrologic conditions surficially. The NJGS analysis of the diversion indicates that even slight increases in pumping could cause the RF plume to migrate.

Therefore, the proposed diversion has the potential to spread ground water contamination and interfere with groundwater remediation, and therefore is not in accordance with N.J.A.C. 7:19-2.2(f)4.

12. The applicant has indicated that the existing Kirkwood-Cohansey diversion sources are not located in a freshwater wetlands or transition area per N.J.A.C. 7:19-2.2(f)6. Although there are

wetlands within the area of the diversion, the wells are existing approved diversion sources with no request to increase their pumping capacity to prevent any impacts on the water table and associated wetlands from the proposed diversion. The Bureau of Freshwater Wetlands has been notified of the proposed diversion.

Piney Point

13. The Piney Point aquifer in the New Jersey Coastal Plain is predominantly confined. The aquifer does not crop out in New Jersey or Delaware. The updip limit terminates in the subsurface in Central Ocean County. The downdip limit is offshore of Ocean County. The Piney Point aquifer is approximately 195-240 feet below the land surface locally with a maximum thickness of approximately 75 feet. The Piney Point is composed of fossiliferous dark gray to greenish sand. The aquifer gets more extensive and hydraulically prolific downdip where it gets thicker.
14. Based upon Capzone, an analytical model, a simulation by the applicant of the proposed increase (68 mgm) coming from all of the Piney Point wells (with the majority of the increase coming from Well 40 then 37), yielded the following aquifer characteristics:

TEST ID	Q (gpm)	T (gpd/ft)	Storativity
Capzone Scenario 3	5,500	80,000	0.5×10^{-3}

Based upon these values, a well screened 190 to 318 deep in the Piney Point aquifer at the requested location would be expected to exhibit confined characteristics, and have a radius of influence for five-feet of drawdown approaching the north and northwest updip limit of the Piney Point and easterly encompassing the Seaside Heights and Seaside Park public supply wells. This radius extends approximately 13,200 feet to greater than 23,760 feet to the southwest of the pumping center.

In reevaluating the analytical model data with the Theis confined aquifer solution of aquifer analysis to simulate the effects of the proposed increase the NJGS used the following values: a Transmissivity of 38,425 gpd/ft, a Storativity of 3.6×10^{-4} (based on the previous Well 40 aquifer test). These parameters calculated a Radius of Influence for five-feet of drawdown at 18,480 feet from the approximate pumping center.

15. Natural replenishment of ground water within the Piney Point aquifer in this area is probably occurring because the observed

fluctuations do not follow a continual decreasing trend and the fluctuations can be attributed to seasonal usage.

Natural replenishment of the Piney Point aquifer has not been occurring on a regional basis, as is illustrated by the findings of the 1998 U.S. Geological Survey Water Resources Report 00-4143. This report documents the expansion of the regional cone of depression in this aquifer's potentiometric surface under Seaside Heights, Seaside Park, Lavallette, and a section of Toms River.

However, the draft 2003 synoptic water level report indicates that two wells in Seaside Heights and one in Seaside Park have shown some recovery between the years 1998 and 2003 (approximately 12 to 46 feet). NJGS has indicated that some coastal wells in the area appear to indicate some recovery in water levels over the past two years (2004 and 2005).

16. The applicant has indicated that approval of the use of Piney Point aquifer would not exceed the natural replenishment or safe yield (water available continuously during projected future conditions, without creating undesirable effects) of the water resource or threatened to exhaust such waters, or render them unfit for use. The model simulated an additional 50 feet of drawdown at Well 40, and did not appear to create dewatering conditions within the Piney Point aquifer in the Toms River area. The Bureau's analysis shows that with an maximum static water level (2001 to 2005) of 80 feet, an additional 50 feet of drawdown would result in water levels 110 feet above the top of the Piney Point aquifer.

In order to confirm this and given the proposed increases in diversion in this region, static water level reports should be required as a condition of this permit to determine future trends.

Therefore, approval of this application at the recommended rates is in accordance with N.J.A.C. 7:19-2.2(f)2.

17. Between 6,800 and 15,500 feet away from the proposed diversion there are seven large capacity wells. The NJGS analysis of the analytical model anticipated a long-term drawdown of five feet at a distance of approximately 18,500 feet based upon Wells 37 and 40 operating at 2700 gpm. The large capacity wells identified, as being within the five feet radius of influence should have sufficient water above their pumps under normal conditions so that interference experienced should not adversely affect their ability to pump their allocations.
18. According to the applicant's consultant, there are seven small capacity private wells located within one mile of the proposed

diversion. Records indicate four of the seven wells appear to be screened in the Piney Point aquifer. Based upon the analytical model and given the complex nature of the hydrologic parameters determined by NJGS, the following table depicts the potential drawdown from the proposed diversion on these wells:

Well Owner *	Approximate distance to pumping Well (feet)	Projected drawdown (feet)
Victoria Grone (3300028692)	5,016	21
Toms River YMCA (2900032884)	3,696	29
Osprey Development (2900003664)	5,174	21
Szewczyk Const. (3300023733)	2,218	36
Kenneth Driscoll (2900007794)	21,000	7
Arthur Dombrowsky (2900000039)	18,100	7
Berkeley Township (3300032188)	11,500	7

* No well records are available to determine well depth, pump setting, static water level, pumping water level or screened interval.

Based upon this information, it appears that four of the seven wells may be impacted by this diversion at the requested rate and experience 20 feet or more of drawdown if they are actually screened in the Piney Point aquifer.

The applicant should be responsible for implementing any corrective actions necessary to existing wells screened in the Piney Point aquifer (listed above but not limited to), that experience any adverse impacts within the radius of influence of the UWTR's Piney Point wells.

Therefore, provided the applicant provides corrective measures if needed the proposed diversion is just and equitable to the other Piney Point aquifer water users in accordance with N.J.A.C. 7:19-2.2(f)3.

19. Analysis of applicant's chloride data indicates that the chloride concentration of Well 37 has been the same for the last 3 years, approximately 2 mg/L in the Piney Point aquifer at this location. According to the applicant's consultant this monitoring result coupled with the additional minimal drawdown experienced (3.2 to 4 feet) in the Seaside Park/Heights wells may affect the saltwater interface slightly based on the minimal change in the regional hydraulic gradient, which they consider negligible. Elevated chloride concentrations are not a consideration in the Piney Point

aquifer at this location. No specific data exists which could provide any insight into the long-term water quality of the wells. According to NJGS, the Piney Point water level data for the wells in the area indicate some recovery in water levels over the past two years (2004 and 2005).

Salt-water intrusion is not expected to occur because the 250 mg isochlor is located 8 miles to the southeast of the UWTR wells and runs south of Seaside Park Borough. Water levels have declined significantly in the coastal wells at Seaside Heights and Lavallette Water Department in the past 5 years but existing water quality data does not suggest any increase in chloride concentrations ccrrelative to declining water levels.

Although the results of local monitoring show that current chloride levels are not indicative of salt-water intrusion conditions, this diversion contributes to the regional potential for salt-water intrusion.

Due to the potential for elevated chloride and sodium concentrations in the Piney Point aquifer in the region the applicant should be required to submit data on chloride and sodium concentrations so that significant changes can be identified and corrective action initiated.

Therefore, approval of this application at the recommended rates is in accordance with N.J.A.C. 7:19-2.2(f)4.

20. Based upon the information provided by the applicant, the diversion is not expected to contribute to the spread of groundwater pollution. According to the applicant's consultant, the diversion is not expected to contribute to the spread of groundwater pollution because the Piney Point aquifer has no outcrop, or recharge area throughout the Coastal Plain. Given its confined nature, and lack of hydraulic connection with the surficial aquifer, increased pumping should not influence the hydrologic conditions surficially. The NJGS analysis of the diversion indicates that significant confining units bound the Piney Point aquifer with the basal Kirkwood confining unit above and the composite confining unit below. This confinement would separate the Piney Point from influencing any surficial contamination in the Toms River region.

Therefore, the proposed diversion will not spread ground water contamination nor interfere with any groundwater remediation in accordance with N.J.A.C. 7:19-2.2(f)4.

21. The applicant has indicated that the existing Piney Point diversion sources are not located in a freshwater wetlands or transition area per N.J.A.C. 7:19-2.2(f)6. Although there are wetlands within the immediate area of the diversion, the diversion is sufficiently confined to prevent any impacts on the water table and associated wetlands from the proposed diversion. The Bureau of Freshwater Wetlands has been notified of the proposed diversion.
22. The applicant should be cognizant of its Piney Point dynamic water levels to ensure that these diversions will not result in the dewatering of the aquifer and threaten the future availability of water to other users of the resource. Based on the complex nature of the aquifer, the amount of regional Piney Point diversions, and the expected future reliance on the aquifer the following dynamic water levels triggers have been calculated to be 25 feet above the top of the Piney Point aquifer (typical trigger level). In this case 25 feet above the top of the Piney Point aquifer is at 170 feet below land surface for Well 37 and 215 feet below land surface for Well 40.

Upper PRM

23. The applicant has requested to keep their existing Upper PRM monthly and annual allocation limits although they can not physically pump their allocation with Wells 42 and 45 alone (since the loss of Upper PRM Well 46). The allocation has not been changed to allow UWTR an opportunity to develop additional Upper PRM sources. If new source(s) are not approved and operational within 5 years, the monthly allocation will be reduced to 100.44 mgm.

Middle PRM

24. The Potomac-Raritan-Magothy aquifer system (PRM) in the northern New Jersey Coastal Plain has been defined as having two unique aquifers: the Farrington (Middle PRM, MPRM) and the Old Bridge (Upper PRM, UPRM), which are correlative to the Raritan and Magothy formations, respectively. Within this aquifer, several water bearing units may be interspersed with local, non-contiguous low permeability units. Downdip in central Ocean County where the PRM aquifer is much deeper below the land surface, a more confined system is commonly encountered. Locally, the MPRM appears to have several water-bearing intervals stratified within some impermeable units that create leaky aquifer conditions. Additionally, the sands of the Lower PRM also provide some leakage during extended pumping operations.

25. The applicant is requesting to operate two of its MPRM sources (Wells 46 and 47) as Aquifer Storage and Recovery wells (ASR). The recovery of water from the ASR wells shall be preceded by the injection of an equivalent storage volume, and the water recovered from storage shall take place within one year of when storage began, resulting in zero net withdrawal from the aquifer. The other MPRM diversion source is Well 30. These sources divert water from the threatened and depleted portion of Middle PRM within Water Supply Critical Area No. 1 (CA1). The applicant will be required to stay within their allotted portion of the safe and dependable yield from the Middle PRM aquifer pursuant to the Water Supply Management Act and N.J.A.C. 7:19-8. This will reduce stress on the aquifer, allow for increased replenishment and recovery of the potentiometric head, and thereby reduce the potential for salt-water intrusion.

The increase in pumping from these sources would create seasonal drawdown within CA1. This drawdown would only occur during the high demand periods coinciding with the summer months with water levels recovering during the following injection periods. Throughout the ASR cycle an equal amount of water will be recharged to the aquifer as is recovered thereafter, thus no net decline in overall water levels is expected.

26. A 72-hour constant rate aquifer test on ASR 46 was conducted in January 2001 with the testing at ASR 47 completed in September 2004. The average pumping rate for ASR 46 was 2,578 gallons per minute (gpm) and 2,602 gpm for the ASR 47 test. Only one observation well was used for each test with this method agreed upon between BWA and the applicant due to the cost of installing observation wells in the deep PRM at the site. During the aquifer testing conducted at ASR 46 and ASR 47, about 86 and 52 feet of drawdown occurred in the wells respectively at the end of the testing.

27. Results of the ASR 46 aquifer test are as follows:

Well No.	Q (gpm)	Depth (feet)	Distance (feet)	Direction	Drawdown (feet)
46	2,578	1,756	0	-	86
OB1	0	1,750	88	East	38

The applicant's consultant using the Hantush, Cooper and Jacob, and Theis methods of aquifer analysis determined that the aquifer exhibited confined characteristics with overlying leakage. Transmissivity was determined to be 59,300 gpd/ft with a

Storativity of 3.0×10^{-3} , while a Radius of Influence of 47,000 feet for a one-foot drawdown was calculated.

In reevaluating the aquifer test data with the Hantush-Jacob method of aquifer analysis the New Jersey Geological Survey determined the following values: a Transmissivity of 53,266 gpd/ft, a Storativity of 1.824×10^{-3} and a Radius of Influence for a one-foot drawdown of greater than 47,000 feet more accurately represent the aquifer's observed response to the test.

28. Results of the ASR 47 aquifer test are as follows:

Well No.	Q (gpm)	Depth (feet)	Distance (feet)	Direction	Drawdown (feet)
47	2,602	1,942	0	-	52
OB1	C	1,939	500	West	24

The applicant's consultant using the Hantush, Cooper and Jacob, and Theis methods of aquifer analysis determined that the aquifer exhibited confined characteristics with overlying leakage. Transmissivity was determined to be 60,300 gpd/ft with a Storativity of 1.19×10^{-3} , while a Radius of Influence of 50,000 feet for a one-foot drawdown was calculated.

In reevaluating the aquifer test data with the Hantush-Jacob method of aquifer analysis the New Jersey Geological Survey determined the following values: a Transmissivity of 60,866 gpd/ft, a Storativity of 1.500×10^{-3} and a Radius of Influence for a one-foot drawdown of greater than 50,000 feet more accurately represent the aquifer's observed response to the test.

29. Natural replenishment of ground water within the MPRM aquifer (Well 30) is probably occurring because the observed fluctuations do not follow a continual decreasing trend and the fluctuations can be attributed to seasonal usage.

Natural replenishment of the MPRM aquifer has not been occurring on a regional basis, as is illustrated by the findings of U.S. Geological Survey Water Resources Report 00-4143. According to 2003 synoptic water level report the three MPRM wells surrounding the UWTR diversion sources have had their water levels decline between the years 1998 and 2003 (approximately 0.05 to 10.00 feet).

The applicant has indicated that approval of the use of MPRM would not exceed the natural replenishment or safe yield (water available continuously during projected future conditions, without creating undesirable effects) of the water resource or threatened to exhaust

such waters, or render them unfit for use. The Bureau's analysis of the application in conjunction with the NJGS review of the aquifer test confirms this. Furthermore, Wells 46 and 47 will be operated as ASR wells. Water recovered should never exceed the quantity previously injected so no net decline in water levels is expected. Some initial drawdown may occur seasonally (during the high demand recovery period), but a full recovery of water levels is expected as the next injection period begins.

In order to confirm this and given the recovery that has occurred within CA1 and adjacent areas coupled with the proposed increases in diversions outside of the Critical Area, static water level reports should be required as a condition of this permit to determine future trends.

Therefore, approval of this application at the recommended rates is in accordance with N.J.A.C. 7:19-2.2(f)2.

30. Between 24,400 and 24,435 feet away from the pumping center of the proposed diversion there are two large capacity wells screened in the MPRM. The NJGS analysis of the aquifer test anticipated a long-term drawdown of five feet at a distance of approximately 13,000 feet based upon the two ASR wells operating together at 4,500 gpm. The large capacity wells identified, as being within radius of influence should have sufficient water above their pumps under normal conditions so that any interference experienced should not adversely affect their ability to pump their allocations.

Therefore, the proposed diversion is just and equitable to the other MPRM water users as it does not adversely affect other existing withdrawals, in accordance with N.J.A.C. 7:19-2.2(f)3.

Therefore, approval of this application at the recommended rates is in accordance with N.J.A.C. 7:19-2.2(f)3.

31. Analysis of applicant's chloride data indicates that chloride concentrations range from 21 to 35 mg/L in the PRM aquifer at this location. According to the applicant's consultant chloride and sodium concentrations for Wells ASR 46 and ASR 47 are less than 12 mg/L and do not reflect an increasing trend indicative of saltwater intrusion. The diversion from these wells is not expected to accelerate the landward movement of the 250 mg/L isochlor concentration interface as any withdrawal of water must be preceded by an equivalent amount of water being placed into storage in the aquifer which would create a mounding affect. Thus no increase in the in the aquifer will be created to accelerate the movement of salt water into the aquifer.

Elevated chloride concentrations are not a consideration in the MPRM aquifer at this location. Saltwater intrusion is not expected to occur because the 250 mg/L isochlor concentration interface is located approximately 8 miles to the southeast and the water quality data does not suggest any increase in chloride concentrations correlative to declining water levels on coastal wells. Furthermore, the operation of the ASR wells should not result in a net decline in water levels.

Due to the potential for elevated chloride and sodium concentrations in the region within the MPRM aquifer the applicant should be required to submit data on chloride and sodium concentrations so that significant changes can be identified and corrective action initiated.

Therefore, approval of this application at the recommended rates is in accordance with N.J.A.C. 7:19-2.2(f)4.

32. Based upon the information provided by the applicant, the MPRM diversion is not expected to contribute to the spread of groundwater pollution. According to the applicant's consultant, the diversion is not expected to contribute to the spread of groundwater pollution because no contamination is within the MPRM at this location and the depth and confinement properties of MPRM would exclude it from spreading surficial contamination. The NJGS analysis of the diversion confirms this.

Therefore, the proposed diversion will not spread ground water contamination nor interfere with any groundwater remediation in accordance with N.J.A.C. 7:19-2.2(f)4.

33. The applicant has indicated that the new MPRM diversion sources are not located in a freshwater wetlands or transition area per N.J.A.C. 7:19-2.2(f)6. Although there are wetlands within 725 to 1850 feet of the proposed diversions, the diversions are sufficiently confined to prevent any impacts on the water table and associated wetlands from the proposed diversion. The Bureau of Freshwater Wetlands has been notified of the proposed diversion.

Summary

The Department has completed its review of this application pursuant to N.J.A.C. 7:19-1 et. seq. The review of this application reveals that portions of it do not have any adverse impacts and meet, based upon the information certified to in the application, the statutory requirements of N.J.S.A. 58:1A-1 et. seq. and the requirements of N.J.A.C. 7:19-2.2 et seq.

Therefore, based upon a review of the information submitted with the application, existing water allocation files, and the New Jersey Geological Survey review of the application, the following conclusions have been reached regarding this application:

- The increase in the monthly allocation from the Piney Point aquifer from 172 mgm to 240 mgm and the establishment of an annual allocation of 1560 mgy should be granted.
- The increase of the combined monthly allocation from Water Allocation Permit Nos. 5000 and 5001 from 554 mgm to 663 mgm should be granted.
- The increase of the combined annual allocation from Water Allocation Permit Nos. 5000 and 5001 from 4282 mgy to 5860 mgy should be granted.
- The establishment of an annual allocation from all diversion sources under Water Allocation Permit No. 5001 of 5385.591 mgy should be granted.
- The establishment of an annual allocation from the UPRM aquifer of 940 mgy should be granted.
- MPRM Wells 46 and 47 operating as ASR sources at 2100 gpm (each) should be granted.
- The reduction of the combined monthly allocation of the Kirkwood-Cohansey aquifer from Water Allocation Permit Nos. 5000 and 5001 from 400 mgm to 389.5 mgm should be granted.
- The requested increase in the monthly allocation from the Kirkwood/Cohansey aquifer by 40 mgm should not be granted.
- Allocations of 188 mgm and 2256 mgy from Kirkwood-Cohansey aquifer sources should be granted.

References

In addition to the historical information on file at the Bureau of Water Allocation and the application submitted, the following information sources were also utilized to establish the recommendations contained within this Staff Report:

Bureau of Safe Drinking Water Inspection Report File

Bureau of Safe Drinking Water Application No. 1507005

LaCombe, Pierre J., Rosman, Robert 2001. Water Levels in, Extent of Freshwater In, and Water Withdrawal from Ten Confined Aquifers, New Jersey and Delaware Coastal Plain, 1998. Water-Resources Investigations Report 00-4143. Washington, D.C. United States Government Printing Office.

- NJDHSS and ATSDR, 1999. Public Health Assessment Reich Farm, Dover Township, Ocean County, New Jersey. New Jersey Department of Health and Senior Services, Trenton, NJ and U.S. Agency for Toxic Substances and Disease Registry, Atlanta, Ga.
- Schaefer, F.L. 1983. Distribution of Chloride Concentrations in the Principal Aquifers in the New Jersey Coastal Plain, 1977-81. Water Resources Investigation Report 83-4061. Washington, D.C. United States Government Printing Office.
- Zapoczka, Otto S. 1989. The Hydrogeologic Framework of the New Jersey Coastal Plain. U.S. Geological Survey Professional Paper 1404-B. Washington, D.C. United States Government Printing Office.
- Nicolson, Robert S., Watt, Martha, K. 1997. Simulation of Ground-water Flow in the Unconfined Aquifer System of the Toms River, Metedeconk River, and Kettle Creek Basins, New Jersey. Water-Resources Investigations Report 97-4066. Washington, D.C. United States Government Printing Office.
- August 1996. Water for the 21st Century: Vital Resource, New Jersey Statewide Water Supply Plan. New Jersey Department of Environmental Protection - Office of Environmental Planning, Trenton, New Jersey.

Recommendations

Issuance of the permit is recommended with an expiration date of ten years from the effective date of the permit and is subject to the attached specific conditions:

Date: _____

Andy MacDonald
Bureau of Water Allocation